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A Critique of the Cross-Country U-Hypothesis

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I

This paper questions the validity of a modern paradigm, viz., the U-Hypothesis. The paradigm prescribes that an inverted U-Curve correctly summarises the intertemporal relationships between economic growth of a nation, and the level of inequality to be found within it: in the early stages of growth, inequality increases, then stabilises and finally in the later stages of growth it declines.

The U-Hypothesis has acquired its paradigmatic status only with the arrival of the recent cross-country studies encompassing both LDCs and DCs. These studies follow upon the earlier basic contributions of Kuznets, whose U-Hypothesis was a secular phenomenon derived from evidence for a few DCs. The fundamental distinction between the secular and cross-sectional (CS) U-Curves is stressed in Section II, and Kuznets's own unambiguous views on the matter are elicited from his seminal writings on the non-comparability of the LDCs and the DCs in the latter's early development phase in a general historical context. Subsequently, in Section III, we scrutinise the major CS U-Curve study to date, viz., Ahluwalia (1976), in some detail, and consider whether the U-Curve doesn't really lead us into a dead-end.

II

Both Paukert (1973) and more explicitly Ahluwalia (1976) attempt to test "the Kuznets hypothesis" with cross-sectional data. The fundamental distinction between a CS as against a time-series analysis is essentially ignored in both these widely cited papers. Even as a casual reading confirms that both Paukert and Ahluwalia interpret their cross-sectional results along inter-temporal lines. Neither is it possible to find a clear awareness of the difference between their specification of the U-Curve as against Kuznets' original statement which was derived from long term data on the income of "the rich". Kuznets did not hypothesise that there was a U-curve characterising the income shares of the bottom 20% or 40%. Thus, even if it were possible with cross-sectional regressions to do so, neither writer is really testing what Kuznets tested. In other words, the implication that the CS work is extending the application of a relationship Kuznets tested for some developed countries to LDCs is inaccurate insofar as the focus is on "the poor" and not on "the rich".

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Yet, the CS literature claims descent from Kuznets, and has now virtually acquired the status of a paradigm, as is evident from the opinions of researchers in this field. Thus, Stewart finds comfort in the fact that Kuznets' "3 stage interpretation of the (very shaky) evidence is consistent with the now widely accepted interpretation of the second type of evidence of income distribution in different countries... (which) supports Oshima's conclusion that countries pass through 4 stages of development.... and that inequality increases through the first 3 stages and diminishes in the fourth" (Stewart, 1978, pp.275-6 emphasis added). Robinson (1976) refers to the U-Curve as a "common empirical finding" for the developed countries, and observes: "This empirical observation has also been seen in modern developing countries - at least the increasing inequality phase - has acquired the force of economic law". Srinivasan (1977) is more circumspect: "it would be wrong to interpret the curve and the projections from it as representing some sort of "iron law" of development" (p.15). But he still accepts that Ahluwalia's "cross-sectional result appears to confirm the Kuznets hypotheses" and that "it is possible to make some limited and stylised policy simulations based on the curve".

In view of the critique of the cross-sectional U-Curve that we will formulate in the following section, it might be useful at the outset to differentiate between the CS and the secular U-Curve approaches. This is perhaps best done by eliciting from Kuznets' own articles, his views on two vital features: firstly, the validity of the cross-country approach; and secondly, the possible applicability of the secular U-Curve (as observed by him in the context of developed countries) to the LDCs of today. Let us consider each in turn.

With regard to the first, methodological question, Kuznets leaves his readers in little doubt. His focus is squarely on long term changes in the secular income distribution profile, but he realises that the necessary data for estimating the secular income structure are not available. When observations for bench-mark years only are possible, there is the likelihood that "even disregarding the margins of error in the data, ... transient disturbances in income levels may be more conspicuous under conditions of primitive material and economic technology (and) would affect the comparison ... made" (1955, p.21). In typical style, Kuznets argues that such hazards force us

"...to examine and evaluate critically the data that are available; it prevents us from jumping to conclusions based on these inadequate data; it reduces the loss and waste of time involved in mechanical manipulations of the type represented by Pareto-curve-fitting to groups of data whose meaning, in terms of income concept, unit of observation, and proportion of the total universe covered remain distressingly vague"; (Kuznets, 1955, p.3).



Further, it is apparent from an earlier important paper that he shuns cross-sectional analysis not just for lack of workable data. Pointing to the fundamental inter-country differences with regard to size, historical heritage, the timing of their industrialisation process, etc., Kuznets (1954; p.153) calls for national studies:

"If the emphasis is to be on similarities and differences in the basic characteristics of the process of adoption of the industrial system - for countries distinguished by their size, historical heritage, and the timing of their industrialisation process - we obviously need a variety of national studies. In these, the interplay among economic growth, population patterns, and social change must naturally be the main focus of interest. Furthermore, the periods covered should be long enough for rates of secular change to be established without confusion with more transient changes. It is from such long period studies, with emphasis on the inter-connexions of secular trends in population, in economic level and structure, in internal political and social institutions, and in the world scene, that we can hope to derive testable conclusions that may be useful in understanding and dealing with problems of the economic growth of underdeveloped countries. The alternative shortcuts prevalent to date - of cross-country comparisons and of studies of population, economic, and social change, each in isolation - have been helpful as suggesting leads but are far from an adequate guide either to testable analytical conclusions or to formulation of long-term policy".

Additionally, and in sharp contrast with the narrow econometric strait-jacket of the CS U-Curve, Kuznets argues that "effective work in this field necessarily calls for a shift from market economics to political and social economy" (1955, p.28).

With regard to the second question viz., whether Kuznets' secular U-Curve was likely to apply to the LDCs as well, Kuznets offers some explicit, though limited insights. While granting that "the pattern of the size-distribution of income characterising underdeveloped countries today is not too different from that observed in the presently developed countries in the 1920's and 1930's, or at the beginning of the century - before the recent trend toward narrower inequality" (Kuznets, 1963, p.68), he points out several dissimilarities between the DCs and the LDCs. One set of these relates to the non-equivalent positions of the LDCs now when compared with the DCs when they were in a "comparable" situation. The pre-industrial per capita incomes in the DCs were very much higher than those prevalent in the LDCs today, while the latter display a much higher growth rate of population than the DCs in their comparable phase. Furthermore, "the large populations of the developed countries of today are a consequence, not an antecedent of their rapid economic growth; and at the crucial earlier stages the population groups were small. The implication for the magnitude of the problems involved in rapid economic growth is obvious" (1954, p.147). So even



though the LDCs income profile was superficially similar to that of the DCs in the 1920's and 1930's "the future cannot be an exact repetition of the past", and industrialisation was not likely to lead to a reduction in inequalities along the lines of the DCs from the 1920's onwards. Kuznets deduced this "by the absence, in these areas (the LDCs), of dynamic forces associated with rapid growth that in the developed countries checked the upward trend of the upper income shares that was due to the cumulative effect of continuous concentration of past savings; and it is also indicated by the failure of the political and social systems of underdeveloped countries to initiate the governmental or political practices that effectively bolster the weak positions of the lower-income classes" (1955, p.24). "Furthermore, the lower economic and income mobility in the underdeveloped countries tends to maintain an unchanging identity of groups at both ends of the income distribution range, and is therefore conducive to continuing income differentials" (1963, p.36). "One may argue that not only the welfare equivalents but also the power equivalents of the same relative income spread now a much wider range when the underlying average income is low than when it is high; and this means that, as time goes on, the spread in economic power will perpetuate and widen still further the underlying income differentials" (1963, p.49). "Furthermore, if and when industrialisation begins, the dislocating effects on these societies .... are likely to be quite sharp, so sharp as to destroy the positions of some of the lower groups more rapidly than opportunities elsewhere in the economy may be created for them" (1955, p.25).

Kuznets therefore argues that the implications of the historical specificity of the LDCs "must be faced unless we are willing completely to disregard past experience or to extrapolate mechanically oversimplified impressions of past development" (1955, p.24). Even at the cost of being repetitive, it is worth emphasising the Kuznetsian position:

"Both the absolute and relative economic position, as well as the general cast of the immediately antecedent history, of the now developed countries in their pre-industrial phase were cardinally different from the economic position and the immediate historical heritage of the underdeveloped countries of today. It is, therefore, far from safe to extrapolate economic or demographic aspects from the earlier records for the developed countries to current and prospective levels for the underdeveloped" (Kuznets, 1954; p151).

### III

In this section we will take up Ahluwalia's suggestion and accord to his CS U-Curve the "serious, if critical, consideration" that he invites. It is possible indeed to agree with a good deal of what Ahluwalia declares: "The use of cross-country data for the analysis of what are essentially



dynamic processes raises a number of familiar problems. Ideally, such processes should be examined in an explicitly historical context for particular countries" (1976, p.307); "the difficulties inherent in this (cross-sectional) methodology are well known, although too often ignored. It is self-evident that the relationships ... identified are primarily associational. They do not necessarily establish the nature of the underlying causal mechanism at work ..." (p.308); with regard to his central U-Curve equation, he confesses that "the true relationship between inequality and development must be fairly complex, reflecting the impact of a number of processes of structural change occurring with development. Such a complex relationship obviously cannot be 'reduced' into a relationship with a single explanatory variable ... The resulting estimated relationships ... tells us nothing about the specific mechanisms through which development effects the degree of inequality" (p.313). "Cross-section analysis should not be used to derive general pronouncements to be applied to all cases ..." (p.331). "A major limitation of our methodology is that it does not permit us to go beyond the simple measurement of rates of growth to examine differences in the type of growth achieved in different situations. Since it is precisely these differences which will determine the distributional impact of growth, we cannot hope to provide any insight into this question by focussing solely on the levels of growth achieved" (p.337). "Recognising this diversity of country experience is perhaps the most important lesson to be learned from the data ... A systematic investigation along these lines can only be conducted in the context of in-depth analysis of the historical experience of particular countries" (p.337). After listing such methodological lapses, Ahluwalia extends his self-criticism, albeit in an appendix, to the data utilised as well. His equation uses one explanatory variable upon which is regressed the dependent variable. With regard to the latter, we can readily agree that "income distribution data are notoriously deficient and the many sources of error affecting them are well known" (p.339). "The concept of income that is relevant for the study of inequality is not easy to define uniquely" (p.339); there are several sampling and non-sampling errors; "the data we have are undoubtedly subject to all these limitations and the result is that our estimates of income distribution are subject to substantial measurement error" pp.341-2). Going even further, Ahluwalia reveals (albeit in a footnote this time) his anxiety about his sole explanatory variable as well. "There are major problems of comparability across countries in using per capita GNP as a measure of the level of development. The use of official exchange rates to convert GNP measured in domestic



currency to GNP measured in US \$ introduces obvious errors since exchange rates typically do not reflect purchasing power parity ... Furthermore, within the developing countries studied, the degree of understatement varies across countries sufficiently to create a switch in per capita GNP rankings. These results indicate that there must be substantial measurement error in our explanatory variables" (sic) (p.313, fn.8). In short, Ahluwalia finds serious defects with his dependent variable, his explanatory variable, as well as with his methodology. The reader might wonder why the matter cannot be laid to rest just there. But unfortunately, as will be argued later, Ahluwalia's practice is not in accordance with his preaching! Indeed, Ahluwalia makes some rather ambitious claims for his cross-country U-Curve. He argues that:

"...We should treat them (the cross country relationships, i.e. the U-Curve) as 'stylised facts' which can be observed, but which still need to be explained, by an appropriate theory. The documentation of such 'stylised facts' is obviously not the same thing as the development of a tried and tested theory, but it may contribute to the development of such a theory in two ways. Firstly, the observed relationships may suggest hypotheses about the nature of the underlying causal mechanisms at work, which then need to be further tested and fashioned into a broader theory. Secondly, they provide yardsticks for verifying theories of distribution and development by defining the observed 'behaviour' that such theories must explain" (Ahluwalia, 1976, p.308).

Ahluwalia's empiricism is somewhat extreme. He does not offer his U-Curve as a hypothesis to be rigorously tested, but as a 'stylised fact' which is established beyond question. He then proceeds to elevate his 'stylised fact' to a higher pedestal: all theories of growth and development are now required by Ahluwalia to be verified against this 'fact'. We do not wish to enter here into a discussion concerning the uses and abuses of empiricism. Rather, we will concern ourselves with the more tedious task of scrutinising Ahluwalia's U-Curve closely to check whether what he refers to as 'stylised fact' couldn't more appropriately be described as 'statistical illusion'.

There are three sets of statistical queries that could be directed at Ahluwalia's estimated U-Curve: firstly, methodological doubts deriving from lapses in the use of regression techniques on cross-sectional data; secondly, those relating to the high sensitivity of the estimates to variations in the size of country-sample used; and thirdly, doubts pertaining to the weakness of the data base, and also to the sensitivity of the results to even isolated data variations. We will consider each in turn.



Methodological objections: Does Ahluwalia heed his own strictures against the abuse of cross-section regression analysis? The fundamental assumption underlying Ahluwalia's OLS regression equations is that from the point of view of explaining the observed variation in the dependent variable (viz., income share of the bottom x%), all cases are homogenous in all respects other than the identified explanatory variable (viz., per capita GNP) and a random element. Thus the equation assumes that the income share of the bottom 20% varies systematically with the level of the GNP per capita alone, and that from the point of view of explaining the cross-country profile of inequality, all initial conditions, structural features and policy variations are of no consequence except insofar as they influence the GNP per capita. Such an assumption is patently untenable. Srinivasan (1977, p.14) seems to offer an escape route when he argues that "the deviation of an individual country observation from the estimated curve should be viewed as the effect of policies being followed as well as other relevant specific features of that country". However, such an interpretation of the estimated residual term can only be called speculative. If policies and structural features of individual countries are important influences on the dependent variable, then these variables must be explicitly introduced into the estimated equation. If this is indeed done, it is quite possible that the significance of the estimated GNP terms could be affected drastically. Unfortunately in none of his many tables of regression results does Ahluwalia provide comparable estimates for the LDC sample from which the effect of including additional relevant variables might be judged.

The more important methodological objection however stems from the implicit homogeneity assumption. Ahluwalia assumes that every LDC will transit along the U-Curve, its pace being dictated by the rate of growth of per capita GNP. The present position of the DCs on the U-Curve reflects the future positions of the LDCs of today, just as the current positions of the LDCs represent points through which the DCs must have transited in their past. Such a compression of the historical process into one well-trodden U-path is somewhat naive. As was argued at length in the previous section, the internal conditions and the international context in which the LDCs of today exist are essentially different from the one in which the current DCs developed. Additionally, the economic and political life of the LDC world is not independent of the DC world. Thus, different cases in Ahluwalia's cross-country regressions are not really independent of each other. Such a dependence would make the cross-sectional exercises even more questionable. This dependence could, of course, also be present between specific countries; e.g., it could be argued that the cases of Puerto Rico and the USA (treated



as independent observations), were perhaps too related for Puerto Rico to be admitted as an "independent" observation into the sample.

Stability of Results: Sample Variations: We will employ as our reference point Ahluwalia's basic U-Curve equation 1(c) of Table 1. This is estimated using his full sample, comprising 60 countries of which 6 are socialist, another 13 are advanced capitalist, and the remaining 41 are developing economies. The fit is reasonable, with an F-value and all estimated coefficients significant at the 1% level, and with 59% of the variation in the dependent variable being explained by the explanatory variables. This is the sample to which nearly all of Ahluwalia's several tables of regression results relate.

The immediate issue which arises concerns the inclusion of the 6 socialist economies in the sample. It should be obvious that the processes which link GNP growth to income distribution are not similar in these countries to those which are assumed to underlie this alleged link for capitalist economies. "Socialism" cannot be treated as an unquantifiable variable which exists alongside economic structures and processes which are essentially similar to those deemed to prevail in the capitalist economies, and which must consequently be included as a "dummy" variable. As such, these 6 countries must be excluded from the sample. At the very least, the reader should be provided with the results for the basic equations, with and without the dummy variable. This Ahluwalia fails to do. He does admit that "the  $\bar{R}^2$ 's for the equations estimated from the full sample are much higher, but this is to some extent due to the fact that the inclusion of socialist countries in this sample adds substantially to the intercountry variance in income shares and the dummy variable for these countries also 'explains' most of this added variance" (p.313, emphasis added). Ahluwalia's failure in making the comparison referred to permits a serious misreading of his results. If the full 60 country sample is used without the dummy variable for the 6 socialist countries, the  $\bar{R}^2$  drops to zero! (see Table 1, Equation I b). The correct procedure is to drop the 6 countries from the sample altogether; when this is done, the  $\bar{R}^2$  drops (from its original value of 0.57) not "to some extent" but drastically to 0.18, as Equation II b of Table 1 shows. Although the estimated coefficients still remain significant, one cannot any more place much reliance in the model as less than a fifth of the total variation is explained; it is quite possible that if other relevant variables were included in the equation, the GNP variables would lose significance. Yet Ahluwalia relies on the full 60 country sample. In fact these results form the basis for his more recent and extended contribution.



The second objection arises from the inclusion of both the DCs and the LDCs in the same sample. It has already been argued at length that the context in which the LDCs have to struggle towards development is fundamentally different from that in which the DCs developed in the past. So, even apart from the structural differences between countries in the different groups, it cannot be assumed that the LDC group could, or will, tread the same path as the DCs. Indeed, one could even argue that the DC group's U-Curve was assisted by the availability of colonies (the erstwhile LDC group). In this sense, the observations for the two groups of countries could not strictly be held to independent of one another. Indeed, this statement is certainly compatible with the evidence presented, where all the LDCs are ranged on the descending leg of the U, and all the DCs are ranged on the ascending one.

On the basis of our line of argumentation we have re-estimated the U-Curve using only the 41 LDC sample. (See Equation III in Table 1.) It will be noticed that while the estimated coefficients retain their statistical significance, their values alter substantially, whereas the  $\bar{R}^2$  remains at nearly a third of the level of the full sample that Ahluwalia utilises. The fit hardly inspires confidence.

Let us now examine the 41 LDC sample results a little more closely, and see how sturdy even Equation III is. For easy reference this equation is repeated as Equation I in Table 2 which also summarises the results for the LDC sample. Firstly, comparing Equations I and IV, we find that the exclusion of just Chad reduces the  $\bar{R}^2$  to a paltry 0.15, and lowers the F-statistic to 4.40 implying a reduction in the significance of the fit from the 1% to the level of 5%. Chad is the poorest country in Ahluwalia's LDC sample. Secondly, we re-estimated the basic equation dropping the 4 richest LDCs, viz., Puerto Rico, Argentina, Chile and Spain. We have already argued that Puerto Rico cannot be taken seriously as an independent observation; nor can the inclusion of Spain in the LDC group be justified. So in Equation VI.b we are effectively dropping the poorest (Chad) and the two richest (Argentina and Chile) LDCs from a 39 country sample, i.e. Ahluwalia's 41 LDCs excluding Spain and Puerto Rico. The result is dramatic: neither coefficient in Ahluwalia's quadratic turns out to be statistically significant even at the 5% level. It turns out that Ahluwalia's quadratic fit, and hence the U-Curve, are the products of a few outliers, and if these are excluded from the sample, the U-Curve fades into insignificance. But Equation VI.a also shows that the better fit is provided not by the U-Curve but rather by the L-Curve.

There are several other inconsistencies in Ahluwalia's argument. For



instance, from his full sample, Ahluwalia (1976) finds that the "turning point" (after which an increase in GNP per capita generates a reduction, rather than an increase in relative inequality) for the bottom 20% is US \$593, whereas from the fully articulated equation that he presents for the same sample, the point is shifted to US \$1454. A little further in his paper, Ahluwalia states that the worsening in relative inequality occurs over the \$75-\$750 range. The bottom 20% can have greater hope if we can believe in Ahluwalia's 41 LDC quadratic equation where they have to wait only till their country's GNP per capita reaches \$381. In one crucial sense, this ambiguity is obviously convenient for as it shelters the number games from being seriously damaged through any verification of the implications of his U-Curve. But, we should expect that for countries on the rising section of the estimated cross-country U-Curve, an observed increase in GNP per capita should lead to a reduction in relative inequality. This proposition can be tested, albeit crudely, by the use of such short and medium time-series data as are available for some countries. On this test, the U-Curve hypothesis performs poorly as Ahluwalia himself notes elsewhere (Ahluwalia et.al., 1979, p.310). There, Ahluwalia (1979) uses a 36 LDC sample, the rich sub-group of which comprises 16 countries "all of which are past the turning point estimated from cross-country data, (but of which) only Taiwan shows some evidence of experiencing the second phase of the Kuznets Curve". This further undermines the U-Curve, and adds credence to the possibility that real relationship for the LDCs could be an I-Curve rather than a U-Curve.

Stability of Results: Data Variations: Variations are possible for the income variable, or for the inequality variable, or for both. With regard to the income (GNP per capita) variable we have already noted the basic problem of comparisons across countries using national official exchange rates. The inequality variable is also fraught with conceptual and measurement problems, as Ahluwalia himself realises. So in the following few paragraphs, we will focus attention on a major shortcoming of the data which Ahluwalia appears to have overlooked (see also Nugent, 1983). Throughout his paper, Ahluwalia refers us to the income share of the top 20% or 40% etc. without being consistent with regard to the entity to which this percentage is to apply. Is it 20% of the population, or households, or labour force? To answer this question we have used Ahluwalia's data source, viz., Jain (1975) for tabulating the type of coverage of the data for the LDC sample of 41 countries. For each case, we have to choose between the type of coverage, i.e. population or income-recipient etc., as also the year to which the observation



relates. Of course, measurement errors would exist in all cases, but Ahluwalia presents no selection criterion for choosing the type of coverage. Neither is his choice consistent, for his 41 LDC sample uses at least 7 distinct types: 19 observations use households at the national level; 7 use the national income-recipients; 5 use national population; for Uganda the distribution refers only to African male employees; in Guyana to national level households but excluding "self-employed persons in the high income bracket", and for Taiwan, the category used is not divulged and an independent source is used though national household distributions are available for 5 points between 1953 to 1972 in Ahluwalia's prime data source, Jain (1975). The same quick-fix approach to the data base is displayed in Ahluwalia (1979) where for a 36 country sample of LDCs, Ahluwalia has prime observations for 25 countries displaying 4 different types of coverage. The origin of the other 11 is more bizarre: for 3 countries for which the income distribution data was not available, Ahluwalia generates his data from the Kuznets curve; the same procedure is adopted for another 7 for which Ahluwalia regards the original data to be unreliable; and incredibly for Iran, for which no data were available, Ahluwalia finds it acceptable to assume that the Venezuela distribution provides an acceptable substitute!

How sensitive are the results to the type of coverage? Given constraints on time and resources, we conducted some limited re-runs of Ahluwalia's U-Curve to investigate this issue. The results are presented in Table 3. In Equation II, we have used income-shares and GNP per capita data for Pakistan for the year 1970-71 relating to the population rather than for 1963-64 for households as in Ahluwalia's equation. The basic source for our alternative data for Pakistan (as also all other variations below) is the same as Ahluwalia, viz., Jain (1975). The result is a noticeable weakening in the goodness of fit. Using alternative data for half dozen countries, we get Equation Vb, where the  $\bar{R}^2$  is reduced to 0.10 and the significance of the estimated coefficients is also cut. Furthermore, using the F-statistic as a criterion, there are grounds for preferring IVa and Va to IVb and Vb, though this is not a serious choice when just about 10% of the variation is being explained.

Neither can we accept Ahluwalia's reasons for not including multiple observations for individual countries where data for the same type of coverage were available for different time points. Ahluwalia says "adding more than one observation for some countries would give too much weight to particular country experience" (p.339). But a fundamental and inescapable premise of his methodology is that all countries are similar in terms of ex-



plaining variations in income inequality except with regard to the GNP per capita. Hence, multiple observations on the same country cannot be deemed to bias the sample.

What then is left of Ahluwalia's elevated "stylised fact" that against which all theoretical explanations were to be tested? The story is told baldly by Equation VIb of Table 2 and Equation Vb of Table 3. As a paradigm, the cross-country U-hypothesis is arguably more of a hindrance than an aid to our comprehension of the relationship between economic growth and income distribution. It obfuscates more than it clarifies.



Table 1: Ahluwalia's Kuznets-Curve Re-examined

| Case | Step | Constant | Socialist Dummy Variable | LN (GNP Per Capita) | (LN GNP Per Capita) <sup>2</sup> | $\bar{R}^2$ | F     | N  | Sample  |
|------|------|----------|--------------------------|---------------------|----------------------------------|-------------|-------|----|---|
| I    | a    | 3.94     |                          | 0.1742<br>(0.67)    |                                  | -0.01       | 0.45  | 60 | Full Sample                                     |
|      | b    | 14.70    |                          | -3.3035<br>(1.16)   | 0.2723<br>(1.23)                 | -0.001      | 0.98  |    |   |
|      | c    | 27.31    | 5.55<br>(8.28)           | -7.3677<br>(3.71)   | 0.5672<br>(3.73)                 | 0.57        | 24.27 |    |   |
| II   | a    |          |                          |                     |                                  |             |       |    | Full Sample<br>Without Social-<br>ist Countries |
|      | b    | 27.10    |                          | -7.2875<br>(3.72)   | 0.5690<br>(3.73)                 | 0.18        | 6.96  | 54 |   |
| III  | a    | 7.77     |                          | -0.5842<br>(1.72)   |                                  | 0.05        | 2.95  | 41 | LDCs only                                       |
|      | b    | 46.09    |                          | -14.3364<br>(3.16)  | 1.1280<br>(3.04)                 | 0.21        | 6.42  |    |   |

Table 2: The Sensitivity of the U-Curve to Sample Variations

| Case | Step | Constant | LN (GNP Per Capita) | (LN GNP Per Capita) <sup>2</sup> | $\bar{R}^2$ | F    | N  | Sample    | Countries Excluded From Sample Used                                   |
|------|------|----------|---------------------|----------------------------------|-------------|------|----|-----------|---|
| I    | a    | 7.77     | -0.5842<br>(1.72)   |                                  | 0.05        | 2.95 | 41 | LDCs only | None  |
|      | b    | 46.09    | -14.3364<br>(3.16)  | 1.1280<br>(3.04)                 | 0.21        | 6.42 |    |           |   |
| II   | a    | 9.29     | -0.8732<br>(2.46)   |                                  | 0.12        | 6.05 | 39 | LDCs only | 1. Puerto Rico<br>2. Argentina  |
|      | b    | 43.72    | -13.4493<br>(2.51)  | 1.1303<br>(2.35)                 | 0.21        | 6.15 |    |           |   |
| III  | a    | 10.73    | -1.1501<br>(3.09)   |                                  | 0.19        | 9.52 | 37 | LDCs only | 1. Puerto Rico<br>2. Argentina<br>3. Chile<br>4. Spain                |
|      | b    | 36.72    | -10.7581<br>(1.73)  | 0.8751                           | 0.22        | 6.15 |    |           |   |
| IV   | a    | 6.86     | -0.4347<br>(1.25)   |                                  | 0.01        | 1.55 | 40 | LDCs only | 1. Chad   |
|      | b    | 39.45    | -13.2126<br>(2.13)  | 1.2220<br>(2.65)                 | 0.15        | 4.40 |    |           |   |
| V    | a    | 8.38     | -0.7221<br>(1.97)   |                                  | 0.07        | 3.88 | 38 | LDCs only | 1. Chad<br>40. Argentina<br>41. Puerto Rico                           |
|      | b    | 39.45    | -11.9880<br>(2.09)  | 1.0063                           | 0.14        | 4.03 |    |           |   |
| VI   | a    | 9.84     | -0.999<br>(2.58)    |                                  | 0.14        | 6.67 | 36 | LDCs only | 1. Chad<br>38. Spain<br>39. Chile<br>40. Argentina<br>41. Puerto Rico |
|      | b    | 31.25    | -8.8592<br>(1.34)   | 0.7115<br>(1.19)                 | 0.15        | 4.08 |    |           |   |
| VII  | a    | 9.28     | -0.8937<br>(2.42)   |                                  | 0.12        | 5.86 | 37 | LDCs only | 1. Chad<br>38. Spain<br>40. Argentina                                 |
|      |      | 33.67    | -9.7807<br>(1.64)   | 0.7981<br>(1.49)                 | 0.15        | 4.14 |    |           |   |



Table 3: The Sensitivity of the U-Curve to Data Variations

| Eqn.<br>No. | Step | Dependent<br>Variable            | Constant | Explanatory Variables  |                                     | $\bar{R}^2$ | F    | Sample  | Countries for<br>which alterna-<br>tive data point<br>is used                         |
|-------------|------|----------------------------------|----------|------------------------|-------------------------------------|-------------|------|---------|---|
|             |      |                                  |          | LN (GNP<br>Per Capita) | (LN GNP<br>per Capita) <sup>2</sup> |             |      |         |   |
| I           | a    | Income<br>Share of<br>Bottom 20% | 7.77     | -0.5842<br>(1.72)      |                                     | 0.05        | 2.95 | 41 LDCs | None  |
|             | b    |                                  | 46.090   | -14.3364<br>(3.16)     | 1.1280<br>(3.04)                    | 0.21        | 6.42 |         |   |
| II          | a    | Income<br>Share of<br>Bottom 20% | 9.518    | -0.859<br>(1.91)       |                                     | 0.06        | 3.64 | 41 LDCs | 1. Pakistan   |
|             | b    |                                  | 50.618   | -15.592<br>(2.47)      | 1.298<br>(2.34)                     | 0.16        | 4.76 |         |   |
| III         | a    | Income<br>Share<br>Bottom 20%    | 9.585    | -0.858<br>(1.79)       |                                     | 0.05        | 3.22 | 41 LDCs | 1. Pakistan<br>2. S.Korea   |
|             | b    |                                  | 46.744   | -14.180<br>(2.08)      | 1.174<br>(1.95)                     | 0.12        | 3.64 |         |   |
| IV          | a    | Income<br>Share of<br>Bottom 20% | 10.134   | -0.962<br>(2.06)       |                                     | 0.08        | 4.25 | 41 LDCs | 1. Pakistan<br>2. S.Korea<br>3. Argentina   |
|             | b    |                                  | 42.651   | -12.620<br>(1.87)      | 1.026<br>(1.74)                     | 0.12        | 3.74 |         |   |
| V           | a    | Income<br>Share of<br>Bottom 20% | 9.769    | -0.892<br>(1.84)       |                                     | 0.06        | 3.38 | 41 LDCs | 1. Pakistan<br>2. S.Korea<br>3. Argentina<br>4. Taiwan<br>5. Costa Rica<br>6. Uruguay |
|             | b    |                                  | 42.905   | -12.776<br>(1.80)      | 1.048<br>(1.68)                     | 0.10        | 3.18 |         |   |



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